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ABSTRACT

This paper examines the relationship that exists between the syntactic and phonological components of the transformational-generative model insofar as their formal structures are concerned. It is demonstrated that the number and importance of the structural similarities between the syntax and the phonology make it necessary to provide for them in the theory. The author suggests this be done by showing that underlying the two components of the grammar there is a single unified structure, with a generative capacity embodied in a set of string-structure rules and a further set of transformational rules converting a deep level of representation to a surface representation and embodying such phenomena as neutralization, ordering, cycling, and other properties. (RL)

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On the Formal Componential Structure of the Transformational-Generative Model of Grammar

Revised version of a paper read to the spring (1970) meeting of the Linguistics Association of Great Britain at Manchester

P.J. Brew

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Most formal models of language make use of some notion of different components or levels into which they see the language as divided. I propose to examine the relationship that exists between the syntactic and phonological components of the transformational-generative model, in so far as their formal structures are concerned. That is, not what is normally meant by their 'interrelation' (for example, whether one is interpretive of the other), but rather simply to compare the formal structure of the one with that of the other.

An example of a model in which this relationship is quite clear - at least in its basic conception - is that of stratificational grammar - and here the relationship is of course that of identity. There is one pattern of formal structure which is exactly repeated at each of the several strata.

Transformational grammarians have criticised stratificational grammar for setting up what they consider to be such a rigid *a priori* theoretical framework. Transformational grammar itself has adopted a far more flexible approach to model building, allowing each component to build up whatever structure it has found necessary in investigating the data, with a minimum of *a priori* constraints. This has meant that, in practice at least, the two components in question - (I am excluding the semantic component only because so little is known about it) - have evolved *largely* independently of each other as far as their formal structure is concerned. In practice, and, it would seem, in theory too, the formal descriptions of the theoretical framwork which are quite frequently given are almost invariably set in terms of one component or the other, or sometimes of one component and *then* the other. Even Chomsky's 1961 paper which bears the promising title 'On the Notion "Rule of Grammar"' turns out to be, in fact, on the notion "rule of syntax". For the phonology we are referred to Halle (1959).

The one exception to this is Chomsky"s early (pre-*Syntactic Structures*) unpublished paper 'The Logical Structure of Linguistic Theory', in which he does sketch out a uniform framework common to all levels of representation. But since then, as far as I know, the idea has not been mentioned again, though there is a brief reference to it in a footnote in *Aspects of the Theory of Syntax*. I take this to indicate that the notion of a uniform structure underlying the different levels or components has been dropped.

But, it may be objected, far from being dropped, the notion has in fact been developed into one of the most important parts of the theory - it is precisely *this* that the whole theory of (formal) linguistic universals is about. In answer to this I would quote from the section of *Aspects* (p.28) in which the theory of (formal) universals is expounded:

> 'Particular assumptions about linguistic universals may pertain to either the syntactic, semantic, or phonological component, or to interrelations among the three components.'

In other words, formal universals are similarities between different languages in one or other of the components. There is no mention here, or elsewhere in the exposition of similarities *between* components. Thus, Chomsky quotes distinctive features as an example of a (substantive)

universal 'with respect to the phonological component' and that the 'syntactic component of a grammar must contain transformational rules ...', as another example.

Of course there is little point in discussing whether the notion of a single underlying componential structure has or has not been 'officially' dropped. It is, I think, a fact that it has virtually not been mentioned since 1955, and what I am suggesting is that it should be re-examined. The rest of this paper will be devoted to presenting the evidence which leads me to make this suggestion.

When I said earlier that in practice the two components have built up their formal structure largely independently of each other, I was not of course implying that they were therefore totally different. Indeed certain similarities have long been noted: for example, the levels of deep and surface structure of the syntax parallel the systematic phonemic and systematic phonetic levels of the phonology; the phonological rules are technically transformational rules which map the 'deep' level of representation onto the surface level; the cyclical application of rules is another example.

But, it seems to me, while these similarities have been noted with interest, no theoretical significance is attached to them, and no explanation is offered for them. To that extent I think it is fair to say that they are treated more or less as coincidences.

I think perhaps there has been one big stumbling-block in the path towards providing the explanation of a single uniform componential structure which I am advocating. This is the <u>essential</u> asymmetry built into the theory by virtue of the fact that the generative capacity of the grammar resides uniquely in the syntax. This, more than anything else is what constitutes the difference in structure between the generative models and most others. The point is made repeatedly in the literature. Thus Chomsky and Halle (1968), p.6:

> 'The part of the grammar which has this recursive property is the syntactic component.'

and Postal (1968), p.205:

> 'The productive (recursive) power of the grammar resides <u>entirely</u> [my emphasis] in the Syntactic Component.'

and:

> '... the Semantic and Phonological Components play a purely [my emphasis] interpretive role.'

One possible way out of this difficulty would be to claim that excluding the phrase-structure component there are sufficient similarities of structure between the syntactic and phonological componets to justify the placing of the phrase structure rules outside of the syntactic component - in fact to set it up as a unique and separate component on its own. This does not seem wholly convincing, however, since the phrase-structure rules clearly are specifically syntactic in nature and seem to belong naturally within the syntactic component.

Fortunately we do not have to fall back on this solution, since there is another to hand. It is simply to show that the statements quoted above are in fact wrong - that the phonological component at least does not play an entirely interpretive role; that it too in fact has a generative capacity. To put it another way, that the term 'generative phonology' is meaningful in its own right, and not simply as short-hand for 'the phonology of generative grammar'.

That Postal's second statement is untrue becomes clear as soon as one considers the long-established secondary role of the phonological component - that of defining the notion 'possible (as opposed to attested) morpheme'. This notion is sharpended by Stanley (1967), who also provides the machinery by which the necessary constraints can be stated, but this function of the phonological component is not new. In fact the notion 'possible morpheme' pre-dates generative grammar. Since the notion is so old, and since this function is clearly in no sense interpretive, it is surprising to find Postal making such a statement.

But if this disproves Postal's second statement, does it necessarily disprove the first? In other words, is it true that the phonology has any generative capacity? I believe it does.

The generative capacity of the grammar consists essentially in the setting up of an inventory of elements together with the convention that they can be concatenated to form strings at the 'deep' level of representation. The role of the phrase-structure rules is then to place heavy constraints on this operation, and thereby to distinguish between well-formed and ill-formed strings. In the syntax, the definition of what constitutes a well-formed 'deep'

string is not in fact entirely left to the PS rules. Further restriction are placed on concatenation by the so-called 'filtering' effect of the transformational rules, and also by the selectional restrictions, which prevent lexical items with certain syntactic features from co-occurring with other, incompatible features. I believe it to be the case that virtually all I have described takes place in the phonological component as well as the syntactic, and that it is therefore necessary to recognise a generative capacity in that component too.

Stanley in 1967, writing on Redundancy Rules in Phonology, clearly saw that the phonological component performed two quite distinct functions and he wished to emphasise this by gathering the morpheme structure rules together - (they were previously scattered throughout the phonological transformational rules) and also by changing the name from 'rules' to 'conditions'. He failed, however, to see the correspondence between these two functions of the phonological component and those of the syntactic component. In view of the correspondence that I wish to establish between the morpheme structure conditions and phrase-structure rules, I would prefer, in order to emphasise this correspondence, to revert to the term 'rule'.

I believe the reason Stanley failed to see a correspondence between morpheme and phrase-structure rules is that, as Fudge has pointed out, he failed to develop his rules to include the crucial element of recursion. As is shown by the above quotation Chomsky and Halle virtually equate the generative capacity with the power of recursion. But Stanley specifically excludes it from the phonology by asserting that the set of possible morphemes of a language is finite, and this is because there is a finite maximum length to the morpheme. There is, is seems to me, absolutely no justification for this claim.

The underlying cause for this confusion is, I believe, the failure on Stanley's part to distinguish between <u>syllable</u> and <u>morpheme</u>. The syllable at present enjoys only semi-official status in the literature of generative phonology, but I think it is becoming increasingly clear that it must be brought fully into the theory. There are two reasons why I believe Stanley to be thinking 'syllable' when he says 'morpheme'. The first is that in illustrating his proposed 'positive morpheme structure conditions' he asks us to 'suppose that all the morphemes in some language are of the form:

$$C\ (L)\ V\ (\{^{C}_{L}\})$$

Now, it is true that the definition of the syllable presents great difficulties, but surely one characteristic is clear - that there will be only one vocalic nucleus per syllable. It is clear then that the language Stanley is asking us to imagine contains exclusively monosyllabic morphemes. This surely cannot be intentional. While the illustrative structure would serve very well as a syllable-structure rule for some language, there are surely few if any natural languages for which it could be a morpheme-structure rule.

The second reason for believing that Stanley is thinking of syllables rather than morphemes is that all the other morpheme-structure rules he mentions would in fact seem to apply to syllables. Take for example the rule of English that the segment which follows a morpheme-initial nasal must be [-consonantal]. Thus a morpheme such as [nup] is permissible while *[ntup] is not. But it is also true that while a morpheme such as [hakniy] is permissible, *[haknt iy] is not. Note that this latter is not covered by the rule mentioned because the nasal is not in morpheme-initial position. Therefore a separate and quite complicated rule would be needed to handle this example. It is I think fairly clear though that in fact it is the same constraint which applies in both cases and that the environment has been wrongly specified. If the rule is seen as a syllable-structure rule and the environment specified as syllable-initial position, then the same rule naturally covers both cases.

If Stanley then, has shown us what syllable-structure rules would be like, it remains to see what a true morpheme-structure rule would be like. This is where the phenomenon of recursion which appeared to be exclusively a property of the phrase-structure rules, comes into the picture. For the difference between a syllable and a morpheme is precisely one of maximum length. While a syllable is finite (and in fact quite short) in length, a morpheme is not. It consists of any number of syllables, usually with no constraints on the types of syllables which may be conjoined. (Vowel harmony constitutes an obvious exception to this, and I shall return to it shortly.) In other words, morpheme-structure rules consist of syllable-structure rules plus the phenomenon of iteration, which is of course a type of recursion. Thus this difference between the phrase- and morpheme-structure rules is reduced considerably. It is not that one involves recursion and the other does not, but simply that while phonology has only iterative recursion, the syntax has embedding as well[1].

In considering the question of whether or not the phonology can be considered to have a generative capacity, one must be careful not to allow considerations of the use to which this generative power is put to enter into the question of whether it exists. There is of course an enormous difference of scale between the ways we use the the two types of generative power, and I believe it may be this difference which has obscured the fact that in their formal structure they are very similar. We use our syntactic generative power every time to speak; we use our phonological generative power only on the rare occasions that we invent new morphemes and on the perhaps less rare occasions when we 'nativize' the pronunciation of a foreign loan-word.

The question of vowel harmony brings me back to the way in which the constraints that apply to the possible concatenation of elements into strings are formulated. At present in the syntax these constraints are expressed in three forms - the PS rules, the selectional constraints and the so-called filtering effect of transformational rules. The correspondences I see are these. Stanley's positive MSR's correspond to the PS rules. The first rule would obviously be:

$$\text{morpheme} \rightarrow \text{syllable}^*$$

The second, for English, would be:

$$\text{syllable} \rightarrow \left(\begin{matrix}\text{initial}\\ \text{C-cluster}\end{matrix}\right) \quad \begin{matrix}\text{vocalic}\\ \text{nucleus}\end{matrix} \quad \left(\begin{matrix}\text{final}\\ \text{C-cluster}\end{matrix}\right)$$

The consonantal clusters would rewrite in terms of stops, liquids, nasals, etc., while the vocalic nucleus would rewrite in terms of simple vowels, dipthongs, and possibly glides.

To the selectional constraints would correspond the rest of the redundancy rules, which are written in terms of the compatibility of various phonological features of segments combined in the same morpheme.

There is a further correspondence which I have not so far mentioned, Stanley's segment-structure rules correspond to the redundancy rules of the lexicon - just as no segment of English can be both [+nasal] and [-voice] so no lexical item can be both [+human] and [-animate].

There is also a correspondence in the third case - that of the filtering effect of T-rules, but this needs some clarification.

Filtering is a necessary second line of constraint after the PS rules because the PS rules themselves, although they allow for recursion, do not provide for any constraint on which simplex string may recursively combine with which other simplex string to form a complex string. Therefore, where such constraints exist - and only in such cases - filtering is necessary. I have shown that recursion is a property of the morpheme-structure rules, so any constraints in its operation would have to be dealt with in the same way. Normally of course, there are, I think, no constraints on which syllables may combine to form complex morphemes - but vowel harmony is the exception. It would therefore be natural to handle it in a similar way to the way the same constraint is handled in the syntax, namely by a special convention 'that a well-formed surface structure cannot contain internal occurrences of the boundary symbol' (Chomsky 1965, p.138), together with the necessary conditions on the transformational rules involved.

In conclusion, then, I believe that I have shown that the number and importance of the structural similarities between the syntax and the phonology make it necessary to provide for them in the theory. I propose that this should be done by showing that underlying the two components of the grammar there is a single unified structure, with a generative capacity embodied in a set of string-structure rules and a further set of transformational rules converting a 'deep' level of representation to a surface representation and embodying such phenomena as neutralisation, ordering, cycling, and many other properties. As a natural extension of this thesis I would suggest that where it is found necessary, on independent grounds, to develop some structure for one component which does not occur in the other, then the evaluation measure should assign some notional 'cost' to this exceptional feature, thereby providing an incentive either to find an alternative way of handling the problem involved, or of showing that there is in fact a need for the new type of structure in the other component also.

[1]Note: The claim that the morpheme-structure rules, like the PS rules, must allow for infinite recursion is of course not crucial to the argument that the phonology is generative. The generative power of the phonology is adequately established if recognition is given to the native speaker's ability to invent new morphemes, and in doing so, to distinguish between well-formed and ill-formed ones.

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